

A PRELIMINARY BIBLIOGRAPHY AND LAKE INDEX  
OF THE INLAND MINERAL WATERS OF THE WORLD

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS  
Rome, September 1972



### Preparation of this Document

This preliminary bibliography and lake index has been prepared by the author on the basis of information available in the Office of Limnology, Hastings College, Nebraska. Although all source material available there has been searched, it is recognized that many papers, especially those published in regional languages may have been left out. Readers are requested to point out such omissions and any inaccuracies that require correction.

This preliminary bibliography will be circulated among specialists in the subject for corrections to the citations and for suggested additions to the list. It is planned that the paper will then be revised to include abstracts of articles available to the compiler and issued as an FAO Fisheries Technical Paper.

WI/D2376

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FAO Fisheries Circular (FAO Fish.Circ.)

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## A PRELIMINARY BIBLIOGRAPHY AND LAKE INDEX OF THE INLAND MINERAL WATERS OF THE WORLD

The preparation of this bibliography and listing of inland mineral lakes is a first attempt to bring together knowledge of these lakes into a single document. The bibliography and lake index covers those bodies of water both temporal and permanent which historically and recently have not been adjoined by estuarine or marine waters. Their lake basins do not directly relate to marine environments, however, wind-blown salts may influence the chemical characteristics of lakes within close proximity to marine waters. The term "athalassic" (non marine) as proposed by Bayly (1967) appears to be an appropriate term for such inland mineral waters.

In the past it has been customary for many hydrobiologists to refer to all types of mineral lakes as saline without distinguishing the major ions present. In reviewing the published material the following ionic types are reported to be the most common (in order of abundance):  $\text{NaCl}$ ,  $\text{NaSO}_4$ ,  $\text{NaHCO}_3$ ,  $\text{MgSO}_4$ ,  $\text{CaSO}_4$ .

All possible intermediates of the above compounds do exist thus suggesting that the current terminology and usage of the term "saline waters" may not from the chemical viewpoint necessarily reflect the abundant proportion of anions, carbonates sulfates and chlorides.

The author has included in this bibliography and lake index only those papers concerning mineralized waters reported to contain salinities and/or conductivities above 3 000 ppm. Data recorded from lakes where the seasonal, annual or long-term periodic salinity varied from slightly below 3 000 ppm to greater concentrations were included. Many of the pre-1920 references have been omitted because more recent observations have updated the hydrobiological information for many of the lakes.

An internationally accepted classification of inland mineral waters formulated upon knowledge of chemical and biological indices needs to be considered. Several scientists have published accounts of classifications, based for the most part on chemical characteristics. Gorrell (1958) described freshwater (0-1 000 ppm); brackish (1 000-10 000 ppm); salty (10 000-100 000 ppm); brine (> 100 000 ppm) and used the sodium and chloride content of waters as the basis for his classification. Beadle (1959) discussed osmotic and ionic regulation of certain organisms in classifying inland saline waters. He proposed: (1) a lower range from fresh to about 15 000 ppm (1.5 percent) and colonized by species which are normal inhabitants of freshwaters; (2) a median range from 15 000 ppm (1.5 percent) to 50 000 ppm (5 percent) inhabited by species which show a preference for saline water; (3) greater than 50 000 ppm (5 percent) where several species of crustacea, i.e., phyllopoda, copepoda, cladocera, are dominant.

Bayly and Williams (1966), recognizing that the dividing line between "fresh" and "saline" non-marine waters is often arbitrary, adopted the convention that saline waters have a salinity greater than 3 000 ppm (0.3 percent). Rawson and Moore (1944) suggested an upper limit of 15 000 ppm (1.5 percent) salinity for the introduction of freshwater fish in the sodium-sulfate type lakes in Saskatchewan, Canada. Wilson and Kister (1956) described saline lakes in the U.S.A. on the basis of dissolved solids content (in ppm): slightly saline (1 000-3 000); moderately saline (3 000-10 000); very saline (10 000-35 000); brine (35 000).



The author with experience in hydrobiological studies of alkaline (bicarbonate-carbonate-hydroxide) lakes in Nebraska, U.S.A., recently classified alkaline habitats in relation to fish production along these lines: (1) slightly alkaline - <900 ppm alkalinity; (2) median alkaline 900-1 200 ppm alkalinity; (3) moderately alkaline - 1 200-1 900 ppm alkalinity; (4) strongly alkaline - > 1 800 ppm alkalinity. The basis for this provisional classification is contained in papers by the author (1970,1971).

The future need to more completely utilize the protein resources of saline-alkaline "athalassic" waters is apparent. Many such waters do not naturally produce maximum fauna crops and are thus potentially receptive towards increased production. Throughout many of the developing countries the more complete utilization of thousands of permanent and temporal mineral waters for the production of food could be of considerable importance in the global fight against hunger and malnutrition. It is in light of this awareness that this publication was prepared.



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Lake Index of the Inland Mineral Waters of the World

<u>Lake</u>	<u>Salinity Range in ppm</u>	<u>Type</u>	<u>Fish Species/Invertebrates</u>
<u>AFRICA</u>			
<u>Algeria</u>			
Bahr Inférieur	11 940—	Na-SO <sub>4</sub>	<u>Gobius fasciatus</u>
Dayet Morselli	35 810—	Na-Cl	<u>Artemia salina</u>
El Bachir	69 570—	Na-SO <sub>4</sub>	
Fontaine Chaude	1 100—	Na-Cl	<u>Tellia apoda</u>
Merdjadja	41 460—	Na-Cl	<u>G. fasciatus</u>
Quargla Chott	67 820—	Na-Cl	<u>A. salina</u>
Salines Arzew	136 270—	Na-Cl	
Sebkha Oran	19 666—	Na-Cl	
<u>Chad</u>			
Mare de Latir	172 000—	Na-SO <sub>4</sub>	
Rombou	23 900—	Na-HCO <sub>3</sub>	
<u>Congo, People's Rep. of</u>			
Gypse de Kapiri	3 000—	Ca-SO <sub>4</sub>	
Saline de Kimengwa	2 700—	Na-Cl	
Saline de Gombela	20 496—	Na-SO <sub>4</sub>	
Saline de Muyuya	5 092—	Na-SO <sub>4</sub>	
<u>Ethiopia</u>			
Abiata	166 000—		
Pawlo	9 100—		
Shala	200 000—		
<u>Kenya</u>			
Baringo	1 000—	Na-HCO <sub>3</sub>	<u>Tilapia nilotica</u>
Crescent			
Elmentaita	11 660—	Na-HCO <sub>3</sub>	
Hannington	53 600—	Na-HCO <sub>3</sub>	
Magadi	20 000—	Na-CO <sub>3</sub>	<u>Tilapia grahami</u>
Maurya			
Naivasha Crater	5 300—		<u>Diaptomus sp.</u>
Nakuru	19 800—	Na-HCO <sub>3</sub>	
Ngomeni Dam	22 600—		
Rudolf	3 465—	Na-HCO <sub>3</sub>	<u>Lates nilotica, Tilapia sp.</u>

Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
<u>Rhodesia</u>			
Gwvalalla (Pan)	2 800—	Na-HCO <sub>3</sub>	<u>Clarias mossambica</u>
Salt (Pan)	1 700—	Na-HCO <sub>3</sub>	<u>Phyllopopoda sp.</u>
Sidina	1 000—	Na-HCO <sub>3</sub>	<u>C. mossambica</u>
<u>Rwanda</u>			
Mohasi	3 100—	Na-Cl	
<u>South Africa</u>			
Barbers (Pan)	1 800—	Na-Cl	<u>Barbus sp.</u>
Eliazar (Pan)	4 000	Na-Cl	<u>Branchinella ornata,</u>
Leeuwkraal (Pan)		Na-Cl	<u>Streptocephalus sp.</u>
Nhlange	3 000—	Na-Cl	
Nyamandhlovu	2 500—	Na-Cl	<u>C. mossambica</u>
Salt (Pan)	211 400—	Na-Cl	
Sifungwe	4 200—	Na-Cl	
<u>Sudan</u>			
Bogar (Pan)		Na-Cl	
Bokalia (Pan)		Na-Cl	
Paya (Pan)		Na-Cl	
Guro (Pan)		Na-Cl	
Jikjik (Pan)		Na-Cl	
Kishikishi (Pan)		Na-Cl	
Kufara (Pan)		Na-Cl	
Kuruadi (Pan)		Na-Cl	
Kurudi (Pan)		Na-Cl	
Madadi (Pan)		Na-Cl	
Sarra (Pan)		Na-Cl	
Umm el Adam (Pan)		Na-Cl	
Unianga Kebir		Na-Cl	
Yarda (Pan)		Na-Cl	
<u>Uganda</u>			
Kako	310 000—	Na-Cl	
Katwee			
Kikorongo			
Kitagata			
Mahiga			
Murumuli			



Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
<u>ASIA AND THE FAR EAST</u>			
<u>Australia</u>			
New South Wales			
Beads	2 444— 3 000	Na-HCO <sub>3</sub>	
Jillamatong	21 244—	Na-Cl	
Queensland			
Buchanan	29 630— 87 624		
South Aust.			
Browne	3 855—	Na-HCO <sub>3</sub>	
Edward	1 200—	Na-SO <sub>4</sub>	
Eliza	276 729—	Na-Cl	
Emerald Springs	3 754—		
Ryre	115 000—	Na-Cl	
Hart	319 794—	Na-Cl	
Leake	5 139—	Na-Cl	
Leg of Mutton	3 000—	Na-ClO <sub>3</sub>	
McDonnell	347 002—		
Pond near Eliza	61 900—	Na-Cl	
Tod Reservoir	1 367—	Na-Cl	
Weedina Springs	3 763—		
Tasmania			
Rushy	3 762—		
Templestowe	7 239—	Mg-SO <sub>4</sub>	

Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
<u>Australia</u> <u>Victoria</u>			
Beac	71 800— 93 100	Na-Cl	<u>Microcylops arnaudi</u> , <u>Calamoecia sp.</u>
Bullenmerri	7 400— 8 600	Na-Cl	<u>Salmo trutta</u>
Buloke	34 776—	Na-Cl	
Calverts Lagoon	3 362— 8 100		
Colac	3 674—		
Coradgill	21 000—	Na-Cl	<u>Austrochiltonia sp.</u>
Corangamite	22 000— 63 000	Na-Cl	<u>Austrochiltonia sp.</u>
Crosby	332 870—	Na-Cl	
Curdare	139 200—	Na-Cl	
Gellies	15 630— 55 980	Na-Cl	
Gnarput	17 900—	Na-Cl	<u>Austrochiltonia sp.</u>
Gnotuk	12 220— 55 980	Na-Cl	
Goldsmith	4 000— 24 000	Na-Cl	
Kariah	22 300—	Na-Cl	<u>Austrochiltonia sp.</u> , <u>Boeckella triarticulata</u>
Keilambete	55 290—	Na-Cl	
Modewarre	3 540— 3 650	Na-Cl	
Murdeduke	5 580— 9 750	Na-Cl	
Raak	320 510—	Na-Cl	
Rosine	8 720—	Na-HCO <sub>3</sub>	
St. Clair (Pool)		Na-Cl	<u>Boeckella triarticulata</u>
Tim Dunn	37 410—	Na-SO <sub>4</sub>	
Weering	172 800—	Na-Cl	
Western Aust.			
Clifton	7 953— 24 000	Na-Cl	
Cowan	235 000—		
Pond near Centre L.	108 900— 290 800	Na-Cl	<u>Parartemia zietziana</u>
Wagin Dam	16 610—		
White	141 900—	Na-Cl	<u>P. zietziana</u>



Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
<u>India</u>			
Burdur	82 872	Na-Cl	
Lonar	3 000	Na-Cl	<u>Cyprinus sp.</u> , <u>Chanos sp.</u>
Periakulam Pool	4 200		
Sakesar Kahar			
Sambhar	9 600	Na-Cl	<u>Artemia salina</u>
Vellore Moat	2 000	Na-Cl	<u>Cyprinus sp.</u> , <u>Chanos sp.</u>
Virudunagar Pool	3 000	Na-HCO <sub>3</sub>	<u>Cyprinus sp.</u> , <u>Chanos sp.</u> , <u>Labeo sp.</u>

Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
<u>EUROPE</u>			
<u>Hungary</u>			
Feherto	233 700	Na-Cl	
Medve			
Nagyszekto			
Palio	2 200	Na-CO <sub>3</sub>	
Ruszanda	6 276	Na-SO <sub>4</sub>	
<u>Italy</u>			
Ganzirri (Sicily)			
Faro	29 000	Na-Cl	<u>Engraulis russoi</u>
Marinello	34 000	Na-Cl	<u>E. russoi</u> , <u>Gobius sp.</u>
Mergolo d. Tonnara	1 450		
Patria	11 000		
Sabaudia	10 000		
Verde	10 360		<u>Hydrobia</u> , <u>Palamontes sp.</u> , <u>Odessia sp.</u>
<u>Romania</u>			
Lacu Sarat	58 038	Na-SO <sub>4</sub>	
Tekir-Chiol	70 877	Na-Cl	
<u>Turkey</u>			
Aci			
Aksehir			
Bataklık			
Beysehir			
Burdur			
Cavusou			
Eber			
Hoyran			
Iznik			
Kurusoh			
Marmara	2 640	Na-HCO <sub>3</sub>	
Salda			
Sugla			
Tuz	250 000		
Van	23 000	Na-Cl	<u>Alburnus tarichi</u>



Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
U.S.S.R.			
Abalakh	5 820—	K-CO <sub>3</sub>	Marinka, <u>Cyprinus carpio</u> , <u>Perca sp.</u>
Ala-Kul	2 840—	Na-SO <sub>4</sub>	<u>Acipenser sp.</u> , <u>C. carpio</u> , other species
Balkhash	260 000—	Na-Cl	
Baskuntschak	352 000—	Na-Cl	
B. Bogatoe	2 300—	Na-Cl	<u>Diaptomus salinus</u>
Bolshoe	3 200—	Na-Cl	<u>Artemia salina</u>
Burlinskoe	2 800—	Na-Cl	Fish species present, <u>Rutilus sp.</u>
Chana	3 500—	Na-Cl	Fish species present
Chary	5 900—	Na-Cl	<u>Rutilus sp.</u> , <u>C. carpio</u> , <u>Stenodus sp.</u> , <u>Esox sp.</u>
Charkhal	6 600—	Na-Cl	<u>C. carpio</u>
Dzhezkazgan	2 200—	Ca-SO <sub>4</sub>	<u>Dunaliella salina</u>
Ebeity	281 000—	Na-Cl	<u>Moina microcephala</u>
Elton	250 000—	Mg-Cl	<u>Gobio sp.</u> , <u>Phoxinus sp.</u> , <u>Diptychus sp.</u> , <u>Salmo sp.</u> , <u>Leuciscus bergi</u> , <u>Leucis</u> <u>schmidtii</u>
Gorkoe	60 000—	Na-Cl	
Issyk-Kul	5 820—	Na-SO <sub>4</sub>	<u>Nemachilus sp.</u>
Kara-Kul	3 000—	Na-Cl	<u>A. salina</u>
Kuchukskoe	4 000—	Na-Cl	<u>A. salina</u>
Petukhouskoe		Na-Cl	<u>A. salina</u>
Sakskoe		Na-Cl	<u>A. salina</u>
Sartlan	1 200—	Na-Cl	<u>Esox sp.</u>
Selenginskoe	3 000—	Na-SO <sub>4</sub>	
Sulfatnoe	40 300—	Na-Cl	<u>A. salina</u>
Tambukan	56 000—	Na-Cl	
Tanatar			
Turaly			

Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
<u>LATIN AMERICA</u>			
<u>Brazil</u>			
Escondida	5 350—	Na-HCO <sub>3</sub>	
<u>El Salvador</u>			
Charmico Coatepeque Zapotitlan	1 100— 3 000	Na-Cl	
<u>Guatemala</u>			
Amatitlan Atitlan		Na-Cl Na-CO <sub>3</sub>	<u>Callinectes sp.</u>
<u>Haiti</u>			
Etang Bois Neuf Etang Saumâtre	29 460— 41 000 7 432— 10 300	Na-SO <sub>4</sub> Na-Cl	<u>Belonid sp.</u> , <u>Gobius fasciatus</u> , <u>Dormitator sp.</u>
<u>Honduras</u>			
Yojoa			
<u>Mexico</u>			
Chichan-Kanab Coyuca Tres Palos	4 446— 21 000— 36 500	Ca-SO <sub>4</sub> Na-Cl Na-Cl	
<u>Nicaragua</u>			
Apeyo Nejapa	6 500— 15 000	Na-CO <sub>3</sub>	
Encantada Huacachima Parinacochas	3 900— 11 400— 12 100	Na-Cl Na-CO <sub>3</sub> Na-Cl	
<u>Peru</u>			



	Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
<u>NEAR EAST</u>				
<u>A.R.E.</u>	Mariut	15 300—56 000	Na-Cl	
	Natron	4 407—6 800	Na-CO <sub>3</sub>	
	Qarun	19 600—29 430	Na-Cl	<u>Tilapia zillii</u> , <u>Mugil cephalus</u> , <u>Solea vulgaris</u> , <u>Mugil saliens</u>
<u>Iran</u>	Gaukhane	25 800—	Na-Cl	
	Maharlou	121 000—	Na-Cl	
	Niris	6 900—	Na-Cl	
	Schor-gol	31 300—	Na-Cl	<u>Artemia salina</u>
	Spring	4 000—	Na-Cl	
	Urmia	148 000—360 000	Na-Cl	<u>A. salina</u>
<u>Iraq</u>	Abbu-Dibis			
	Bahral Milh			
	Hawr al Habbanyah			
	Mileh Tharthar		Na-Cl	
<u>Israel</u>	Afikim Ponds	2 200—3 300	Na-Cl	<u>Cyprinus carpio</u>
	Dead Sea	32 000—34 000	Na-Cl	
	Dead Sea Pond A	4 500—8 600	Na-Cl	<u>Tilapia nilotica</u> , <u>T. aurea</u> and hybrids
	Dead Sea Pond B	3 800—11 800	Na-Cl	<u>T. nilotica</u> , <u>Mugil cephalus</u>
	Solar (Elat)	44 000—90 000	Na-Cl	<u>A. salina</u> , <u>Robertsonia salsa</u>
<u>Libya</u>	Tauorga			
<u>Somali Republic</u>	Abbe			
	Affambo			
	Gamarri			

Lake	Salinity Range in ppm	Type	Fish Species / Invertebrates
<u>NORTH AMERICA</u>			
<u>Canada</u>			
Alberta			
Czar	2 300—	Na-SO <sub>4</sub>	<u>Esox lucius</u> , <u>Culaea inconstans</u>
Fleeinghorse	2 000—	Na-SO <sub>4</sub>	<u>Pimephales promelas</u>
Gillespie	1 100—	Na-SO <sub>4</sub>	<u>Branchineota</u> sp.
Keoma	5 000—	Na-SO <sub>4</sub>	<u>C. inconstans</u> , <u>E. lucius</u>
Miquelon	1 500—	Na-SO <sub>4</sub>	
British Columbia			
Boitano	4 000—	Na-SO <sub>4</sub>	Fish species present
Bowers	10 900—	Mg-SO <sub>4</sub>	
Box 4	3 000—	Na-HCO <sub>3</sub>	
GR 2	19 000—	Na-CO <sub>3</sub>	
Ironmask	13 600—	Na-SO <sub>4</sub>	
LB 1	13 750—	Mg-SO <sub>4</sub>	
Long	4 750—	Na-SO <sub>4</sub>	
Lyons	8 000—	Ca-SO <sub>4</sub>	
Mahoney	10 000—	Ca-SO <sub>4</sub>	
One Mile	35 500—	Mg-SO <sub>4</sub>	
Phalerope	2 820—	Na-HCO <sub>3</sub>	
Polygon	13 300—	Na-SO <sub>4</sub>	
Rush	3 000—	Na-SO <sub>4</sub>	
Three Mile	9 280—	Mg-SO <sub>4</sub>	
White	3 200—	Na-HCO <sub>3</sub>	
Manitoba			
Beauford	8 386—	Na-SO <sub>4</sub>	
Crawford	10 311—	Na-SO <sub>4</sub>	
Eighteen	3 981—	Na-SO <sub>4</sub>	
Horseshoe	5 982—	Na-SO <sub>4</sub>	
Nora	3 530—	Mg-SO <sub>4</sub>	
Raven	9 346—	Na-SO <sub>4</sub>	
Salt	6 200—	Na-SO <sub>4</sub>	
Shoal	6 281—	Na-SO <sub>4</sub>	



Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
Saskatchewan			
Antelope	13 170	Na-SO <sub>4</sub>	
Basin	11 190	Na-SO <sub>4</sub>	
Big Quill	16 550	Na-SO <sub>4</sub>	
Bitter	14 050	Na-HCO <sub>3</sub>	
Charron	7 080	Na-SO <sub>4</sub>	
Fishing	3 227	Mg-SO <sub>4</sub>	
Last Mountain	2 402	Na-SO <sub>4</sub>	
Lenore	6 034	Mg-SO <sub>4</sub>	
Little Manitou	80 114	Na-SO <sub>4</sub>	
Little Quill	10 850	Na-SO <sub>4</sub>	
Manito	15 530	Mg-SO <sub>4</sub>	
Redberry	11 572	Mg-SO <sub>4</sub>	
Soda	9 318	Na-SO <sub>4</sub>	
Stoney	4 627	Mg-SO <sub>4</sub>	
Wakaw	2 800	Mg-SO <sub>4</sub>	
			<p><u>Pimephales promelas</u></p> <p><u>S. vitreum</u>, <u>Catostomus sp.</u>, <u>Lota lota</u></p> <p><u>E. lucius</u>, <u>Perca flavescens</u></p> <p><u>A. salina</u></p> <p><u>G. aculeatus</u></p> <p><u>Gasterosteus aculeatus</u></p> <p><u>Fish species present</u></p>

Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
<u>United States of America</u>			
<u>Arizona</u>			
Green Pond	61 300—112 000	Na-HCO <sub>3</sub>	<u>Artemia salina</u>
Painted Rock	4 800—15 000	Na-Cl	<u>Tilapia mossambica</u> , <u>Gambusia affinis</u>
Papago	1 900—3 800	Na-Cl	<u>Diaptomus dorsalis</u>
Red Pond	220 000—	Na-Cl	<u>Artemia salina</u>
<u>California</u>			
Badwater	27 750—43 700	Na-Cl	<u>Cyprinodon nevadensis</u>
Bristol (playa)	279 000—	Na-Cl	
Cadiz (playa)	73 600—	Na-Cl	
Dale (playa)	298 000—	Na-Cl	
Danby (playa)	271 000—	Na-Cl	
Elsinore	8 800—60 000	Na-Cl	
Kane (playa)	210 000—	Na-Cl	
Mono	50 000—60 000	Na-Cl	<u>Artemia salina</u>
Owens	60 000—80 000	Na-Cl	<u>Artemia salina</u>
Salton Sea	32 000—35 800	Na-Cl	<u>Anisotremus davidsoni</u> , <u>Bairdiella sp.</u> , <u>Cynoscion sp.</u>
Searles (playa)	344 000—	Na-Cl	
<u>Colorado</u>			
Banner#12	3 140—4 928	Na-SO <sub>4</sub>	<u>Fundulus kansae</u> , <u>Archoplites interruptus</u> , <u>Lepomis gibbosus</u> , <u>Pimephales promelas</u>
Banner#13	3 521—6 924	Na-SO <sub>4</sub>	<u>F. kansae</u> , <u>A. interruptus</u> , <u>P. promelas</u>
Big Swede	5 486—8 400	Na-SO <sub>4</sub>	
Gaynor	4 524—7 200	Na-SO <sub>4</sub>	
Henry	900—3 000	Na-SO <sub>4</sub>	<u>L. gibbosus</u> , <u>Pomoxis sp.</u> , <u>Ictalurus melas</u> , <u>Cyprinus carpio</u>
Meridith	4 264—11 415	Na-SO <sub>4</sub>	<u>I. melas</u> , <u>C. carpio</u> , <u>L. gibbosus</u>
Midge	11 094—	Na-SO <sub>4</sub>	<u>F. kansae</u>
Muddy	4 200—5 800	Na-SO <sub>4</sub>	
Nee Grande	10 100—14 300	Na-SO <sub>4</sub>	<u>F. kansae</u>
Newell	6 800—19 862	Mg-SO <sub>4</sub>	<u>F. kansae</u> , <u>L. gibbosus</u> , <u>A. interruptus</u> , <u>C. carpio</u>
Queens	2 355—3 143	Na-SO	<u>L. gibbosus</u> , <u>I. melas</u> , <u>C. carpio</u> , <u>Stizostedion vitreum</u> , <u>Roccus chrysops</u>



Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
<b>Kansas</b>			
Dry (playa)	6 000—12 500	Na-SO <sub>4</sub>	Phyllopoda sp.
Little Salt Marsh	4 800—8 800	Na-SO <sub>4</sub>	Fundulus kansae
Salt	11 000—14 500	Na-Cl	<u>F. kansae</u>
Slate Valley	7 700—38 000	Na-Cl	
Wilson Res.	1 600—3 000	Na-Cl	Stizostedion vitreum, <u>Morone saxatilis</u>
<b>Montana</b>			
Alkali		Na-SO <sub>4</sub>	
Box Elder	980—2 000	Na-HCO <sub>3</sub>	
Brush	6 000—7 500	Na-SO <sub>4</sub>	Salmo gairdneri
Crane		Na-SO <sub>4</sub>	<u>Culaea inconstans</u>
Lost	153 787—	Na-SO <sub>4</sub>	
Medicine	2 300—3 000	Na-HCO <sub>3</sub>	
Plentywood	115 000—125 000	Na-SO <sub>4</sub>	Pimephales promelas, <u>Esox lucius</u> , <u>C. carpio</u> ,
South Westby	91 000—	Na-SO <sub>4</sub>	<u>C. inconstans</u> , <u>Catostomus commersoni</u>
Westby	137 000—	Na-SO <sub>4</sub>	
<b>Nebraska</b>			
Alkali#1	52 300—66 500	Na-HCO <sub>3</sub>	Branchinecta lindahli
Alkali#2	15 300—26 780	K-CO <sub>3</sub>	<u>Artemia salina</u>
Antioch	43 000—47 500	Na-CO <sub>3</sub>	Moina sp.
Ashenburger	3 200—3 825	Na-CO <sub>3</sub>	<u>A. salina</u>
Bean	2 600—4 200	Na-HCO <sub>3</sub>	
By-Way	58 000—66 200	Na-HCO <sub>3</sub>	P. promelas
Cook	3 300—6 200	Na-CO <sub>3</sub>	<u>A. salina</u>
Cravath	4 200—12 350	Na-HCO <sub>3</sub>	<u>Diaptomus</u> sp.
Diamond	2 600—4 650	Na-HCO <sub>3</sub>	<u>Diaptomus</u> sp.
East Twin	79 000—82 000	Na-CO <sub>3</sub>	<u>P. promelas</u>
East Valley	2 400—3 800	Na-HCO <sub>3</sub>	<u>A. salina</u>
Goose	30 000—35 500	Na-HCO <sub>3</sub>	<u>Diaptomus</u> sp.
Grubry	11 600—16 800	Na-CO <sub>3</sub>	<u>A. salina</u>
Homestead	3 400—4 500	Na-CO <sub>3</sub>	<u>A. salina</u>
Jennings	52 300—78 600	Na-HCO <sub>3</sub>	<u>Diaptomus</u> sp.
Jesse	6 200—8 800	Na-CO <sub>3</sub>	<u>A. salina</u>
Kennedy	16 100—28 500	Na-CO <sub>3</sub>	
Lakeside	12 300—14 500	Na-CO <sub>3</sub>	<u>Diaptomus</u> sp.
Lilly		Na-CO <sub>3</sub>	<u>Branchinecta</u> sp.

Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
Nebraska cont.			
Little Alkali	3 450—	Na-HCO <sub>3</sub>	<u>Diaptomus sp.</u>
Lost	5 490—	Na-HCO <sub>3</sub>	
McKeel	1 100—	Na-HCO <sub>3</sub>	<u>Pimephales promelas</u>
Miles	7 400—	Na-CO <sub>3</sub>	
Patton	5 200—	Na-CO <sub>3</sub>	
Reno	32 100—	Na-CO <sub>3</sub>	<u>Artemia salina</u>
Richardson	36 000—	Na-CO <sub>3</sub>	<u>A. salina</u>
Potash	15 200—	K-CO <sub>3</sub>	<u>Branchinecta sp.</u>
School	2 850—	Na-HCO <sub>3</sub>	<u>P. promelas</u>
Smithys	3 200—	Na-HCO <sub>3</sub>	<u>P. promelas</u>
Walters	3 500—	Na-HCO <sub>3</sub>	<u>Diaptomus sp.</u>
West Long#1	2 850—	Na-HCO <sub>3</sub>	<u>Branchinecta sp.</u>
Nevada			
Big Soda	24 700—	Na-Cl	<u>Siphateles sp.</u>
Carson		Na-Cl	<u>A. interruptus</u> , <u>Siphateles sp.</u>
Little Soda	5 310—	Na-SO <sub>4</sub>	<u>A. interruptus</u> , <u>Salmo clarki</u> , <u>Catostomus</u>
Pyramid	4 700—	Na-Cl	<u>tahoensis</u> , <u>S. bicolor</u>
Twin	2 500—	Na-SO <sub>4</sub>	<u>S. bicolor</u> , <u>S. clarki</u> , <u>Rhinichthys sp.</u>
Walker	6 850—	Na-Cl	<u>S. clarki</u> , <u>S. bicolor</u> , <u>A. interruptus</u> , <u>C. tahoensis</u>
New York			
Fayetteville-Green	2 200—	Ca-SO <sub>4</sub>	
Onondaga	5 000—	Ca-Cl	
Round	2 300—	Ca-SO <sub>4</sub>	



Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
New Mexico			
Bitter	7 000—27 300	Na-Cl	
Black	1 700—33 000	Na-SO <sub>4</sub>	<u>Salmo gairdneri</u> , <u>C. macularius</u> , <u>F. zebrinus</u>
Cottonwood	4 000—8 100	Na-SO <sub>4</sub>	<u>F. zebrinus</u> , <u>S. gairdneri</u> , <u>C. carpio</u> , <u>Micropterus salmoides</u> , <u>L. cyanellus</u>
Devils Inkwell	4 100—4 830	Na-SO <sub>4</sub>	<u>F. zebrinus</u> , <u>C. macularius</u>
Figure Eight	9 240—11 000	Na-SO <sub>4</sub>	<u>Cyprinodon rubrofluviatilis</u> , <u>macularius</u>
Lazy Lagoon	25 000—	Na-SO <sub>4</sub>	<u>Cyprinodon macularius</u>
Lea	7 220—10 600	Na-SO <sub>4</sub>	<u>Gambusia</u> sp.
Lander Springbrook	2 782—3 300	Mg-SO <sub>4</sub>	
Pasture	3 900—6 800	Na-SO <sub>4</sub>	<u>F. zebrinus</u> , <u>S. gairdneri</u> , <u>C. macularius</u>
Willow	3 465—4 200	Mg-SO <sub>4</sub>	<u>F. zebrinus</u> , <u>C. macularius</u>
North Dakota			
Blue		Na-SO <sub>4</sub>	
Brekken		Na-SC <sub>4</sub>	
Clearwater			
Cottonwood	8 532—	Na-SO <sub>4</sub>	
Cranberry	23 100—	Na-SO <sub>4</sub>	
Crooked	13 973—16 400	Mg-SO <sub>4</sub>	
Douglas A	51 857—	Na-SO <sub>4</sub>	
Devils	3 000—12 500	Na-SO <sub>4</sub>	
Eastern Stump	60 000—108 000	Na-SO <sub>4</sub>	
Free Peoples	8 600—	Na-SO <sub>4</sub>	<u>Esox lucius</u>
George	15 200—15 800	Na-SO <sub>4</sub>	
Horseshoe	5 630—	Na-SO <sub>4</sub>	
Lower Lostwood	93 180—	Na-SO <sub>4</sub>	
McKone	142 600—	Na-SO <sub>4</sub>	
Miller	185 000—	Na-SO <sub>4</sub>	<u>Artemia salina</u>
Moon	5 400—6 200	Na-SO <sub>4</sub>	<u>S. gairdneri</u> , <u>Gasterosteus aculeatus</u>
Nettie			
Nyston			
Nelson			
Round			
Shell	2 600—3 200	Na-HCO <sub>3</sub>	<u>A. interruptus</u> , <u>Gasterosteus aculeatus</u>
Seven Mile			
Sletton			
Spring	4 190—	Na-SO <sub>4</sub>	

Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
North Dakota cont.			
Stink (Williams)	120 000—	Na-SO <sub>4</sub>	<u>Artemia salina</u>
Standley A	199 813—	Na-SO <sub>4</sub>	
Three Mile	19 565—	Na-SO <sub>4</sub>	
Thompson			
Turtle			
Westby A	191 000—	Na-SO <sub>4</sub>	
Westby B	157 000—	Na-SO <sub>4</sub>	
Westby C	128 000—	Na-SO <sub>4</sub>	
Western Stump	3 100—	Na-SO <sub>4</sub>	
White	94 327—	Na-SO <sub>4</sub>	
Oklahoma			
Salt Plains Res.	2 600—	Na-Cl	<u>Cyprinus carpio</u> , <u>Fundulus kansae</u>
Oregon			
Abert	10 400—	Na-Cl	
Bluejoint	3 640—	Na-CO <sub>3</sub>	
Harney	22 000—	Na-Cl	
Summer	18 000—	Na-Cl	
South Dakota			
Bitter	8 720—	Na-SO <sub>4</sub>	
Byron	1 600—	Na-SO <sub>4</sub>	
Cooley	40 890—	Na-SO <sub>4</sub>	
Ft. Sissaton	2 000—	Mg-SO <sub>4</sub>	
Horseshoe	4 300—	Mg-SO <sub>4</sub>	
Hazelden	7 060—	Na-SO <sub>4</sub>	
Long	9 000—	Mg-SO <sub>4</sub>	
Medicine	35 000—	Mg-SO <sub>4</sub>	
McKilloans	5 176—	Mg-SO <sub>4</sub>	
Minnewasta	1 800—	Na-SO <sub>4</sub>	<u>Ictalurus melas</u>
Nicholson	80 292—	Na-SO <sub>4</sub>	
Oakwood	2 500—	Mg-SO <sub>4</sub>	
Piyas	2 570—	Mg-SO <sub>4</sub>	<u>Pimephales promelas</u>
Red	2 200—	Na-SO <sub>4</sub>	<u>P. promelas</u>
Round	8 800—	Mg-SO <sub>4</sub>	
Stink	11 920—	Na-SO <sub>4</sub>	
Waubay	4 690—	Mg-SO <sub>4</sub>	<u>Gasterosteus aculeatus</u>



Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
Texas	Balmorhea	Na-Cl	Fish species present
	Bull	Na-Cl	
	Cedar	Na-Cl	
	Coyote	Na-Cl	
	Danial Salt Res.	Na-SO <sub>4</sub>	
	Ft. Stockton	Na-SO <sub>4</sub>	
	Hamlin	Na-Cl	
	Imperial Res.	Na-Cl	Fish species present
	Kemp	Na-Cl	<u>C. carpio</u> , <u>Fundulus sp.</u> , <u>Carpionodes sp.</u> ,
	Pauls	Na-Cl	<u>I. melas</u>
	Red Bluff Res.	Na-Cl	<u>Paralichthys lethostigma</u> , <u>Sciaenops ocellata</u>
	Rich	Na-SO <sub>4</sub>	Fish species present
	Silver	Na-SO <sub>4</sub>	
	Tahoka (playa)	Na-Cl	
Utah	Toyah	Na-SO <sub>4</sub>	<u>Morone chrysops</u> , <u>S. ocellata</u> , other species
	White	Na-SO <sub>4</sub>	
	Great Salt	Na-Cl	<u>Artemia salina</u>
	Sevier	Na-Cl	Fish species present
Washington	Blue	Na-SO <sub>4</sub>	<u>A. salina</u>
	Clear	Na-SO <sub>4</sub>	
	Hot	Mg-SO <sub>4</sub>	
	Lenore	Na-CO <sub>3</sub>	
	Lower Goose	Na-SO <sub>4</sub>	
	Medical	Na-SO <sub>4</sub>	
	Moses	Na-CO <sub>3</sub>	
	Newman	Na-CO <sub>3</sub>	<u>Salmo olarki</u> , <u>Hybopsis sp.</u> ,
	Omak	Na-CO <sub>3</sub>	<u>Catostomus rimiculus</u>
	Soap	Na-CO <sub>3</sub>	
	Wannacutt	Mg-SO <sub>4</sub>	<u>S. olarki</u>

Lake	Salinity Range in ppm	Type	Fish Species/Invertebrates
Wyoming			
Alkali Res.	3 750	Ca-SO <sub>4</sub>	Fish species present
Aurora	2 600	Na-SO <sub>4</sub>	Fish species present
Chases Res.	3 280	Na-SO <sub>4</sub>	<u>Salmo gairdneri</u>
Clark Res.	2 800	Na-SO <sub>4</sub>	<u>S. gairdneri</u>
Cranes Res.	2 800	Na-SO <sub>4</sub>	
Gillette Res.	6 100	Mg-SO <sub>4</sub>	
Jackson	57 700	Na-SO <sub>4</sub>	
Miller	21 000	Na-SO <sub>4</sub>	
Mud Springs Res.	2 820	Mg-SO <sub>4</sub>	Fish species present
Oliver Res.	2 900	Na-SO <sub>4</sub>	<u>S. gairdneri</u>
Peters Res.	6 300	Mg-SO <sub>4</sub>	<u>S. gairdneri</u>
Pickett #2	6 000	Na-HCO <sub>3</sub>	
Soda #1	4 260	Na-SO <sub>4</sub>	Fish species present
Y Res.	5 000	Na-SO <sub>4</sub>	<u>S. gairdneri</u>











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